A Project Report

Project Name: Density Based Traffic control for Smart Ambulance System

4.1 Methodology for the Study

Traffic congestion is the biggest problem faced by densely populated cities. This work mainly aims on providing solution for the problem faced by ambulances which are moving towards the traffic signal during high density traffic. Using traffic camera ,Acoustic Sensor and IR Sensor, we are going to detect the ambulance and measure the traffic density in a lane. Measuring traffic density and detecting ambulance using Traffic Camera is based on image processing. Then, those result will processed to raspberry pi to turn on traffic light based on result. If ambulance is present in a lane, that lane will be prioritized first compare to other lane. Based on traffic density also traffic is prioritized. This module is also advantageous on high priority vehicles such as fire disaster prevention vehicles, VIP vehicles and Police Jeeps which are heading towards high density traffic signals.

4.2 Modeling, Analysis & Design

This Project Consist of Hardware and Software Component.

Hardware Component:

- Led lights.

- Raspberry pi.
- Wires
- Ethernet Cable
- USB Type C Cable
- Breadboard

Software Component

- Software programming modules – OpenCV (Open Source Computer Vision) Library
- num py.
- Language Used – Python 3.10.4.

Traffic density can be measure in two step using Computer Vision

- First to detect Vehicle.
- Second to count no.of vehicle.

(i) To Detect Vehicle in Video

To detect vehicle in video, first we need to separate the background and convert the video in RGB colour to Grey scale. now, all moving object will be in grey colour. The Figure 4.2 and 4.3 shows the RGB and Greyscale of Video.

FIGURE 4.2: RGB Screenshot

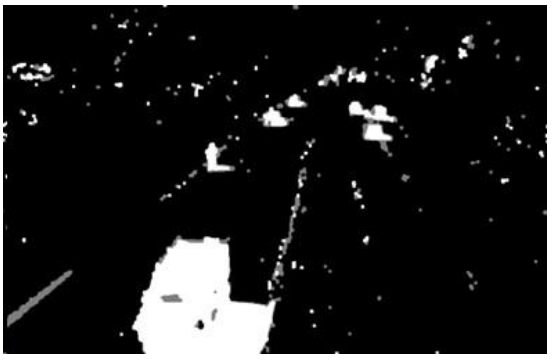

FIGURE 4.3: Greyscale Screenshot

(ii) To Count no.of Vehicle in Video

Once we able to detect vehicle in video. Next, we draw bounding box on detected vehicle. Then need to draw a line to count the no.of vehicle. Once the Vehicle cross the line its start counting the no.of vehicle present in the lane.

The Figure 4.4 and 4.5 shows the Bounding Box of Vehicle in video and Vehicle Count.

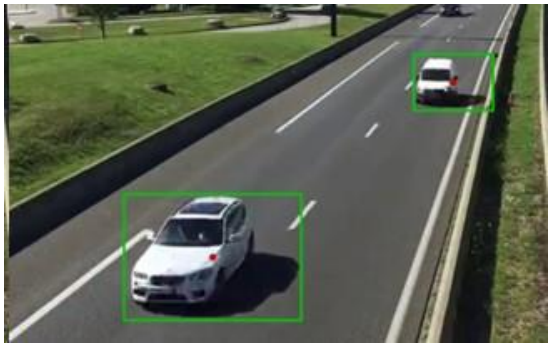

FIGURE 4.4: Bounding Box Screen- shot

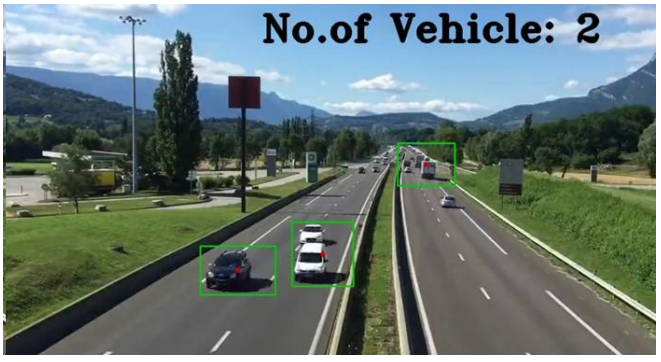

FIGURE 4.5: Vehicle Count Screenshot

Even after we able to count vehicel. It is not able to count vehicle correctly. Reason is noise is present in the video. Vehicle is detecting Based on Grey scale. Unwanted things like tree, grass also considering as vehicle.

The Figure 4.6 and 4.7 shows the Noise in RGB nad greyscale.

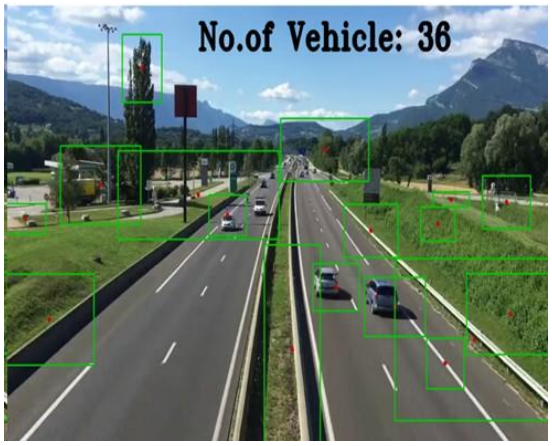

FIGURE 4.6: Noise in RGB Screen-shot

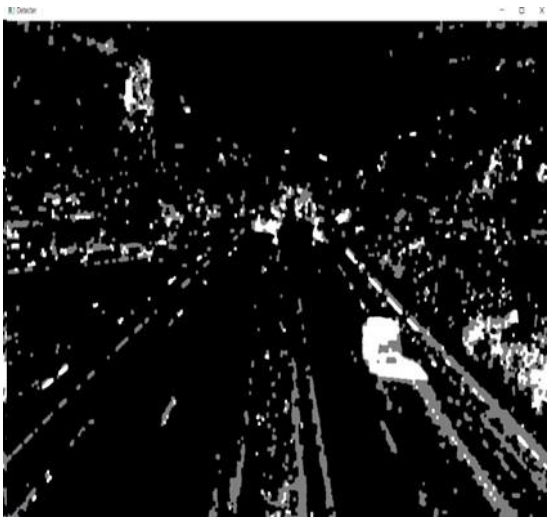

FIGURE 4.7: Noise in Greyscale Screenshot

Since noise is present in video. To remove noise in the video, we going to apply VarThreshold on greyscale of the video.After Applying Var threshold = 500 in Greyscale, model is working well.

The Figure 4.8 and 4.9 shows the Noise removed in RGB nad greyscale.

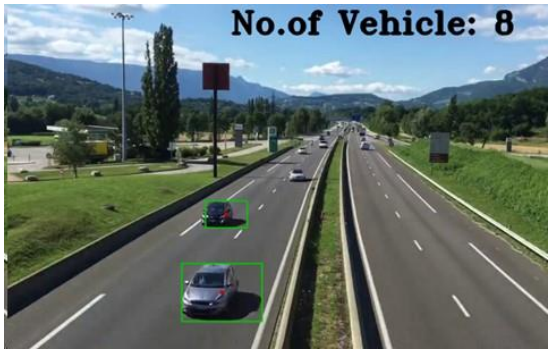

FIGURE 4.8: Noise Removal in RGB Screenshot

FIGURE 4.9: Noise in Greyscale Screenshot

Detect The ambulance presence in traffic using Computer Vision

To Detect ambulance in the video, we use yolo to detect. Yolo is an algorithm that detects and recognizes various objects in a picture (in real-time).

FIGURE 4.13: Ambulance 1

FIGURE 4.14: Ambulance 2

Object detection in YOLO is done as a regression problem and provides the class probabilities of the detected images.

Yolo have already pre-trained model dataset called coco names. some of the pre-trained models are person, bicycle,car, motorbike, aeroplane, bus, train, truck, boat, etc.The Figure 4.13 and 4.14 shows sample images of ambulance whhic are used to train image model.

FIGURE 4.15: Ambulance Detection 1

FIGURE 4.16: Ambulance Detection 2

Ambulance is not present in the pre-trained model dataset called coco names. So, now we need to traine our own model for ambulance detection. To train the ambulance, we took 446 image of ambulance to train model. some of the sample image are

we use google collab to train the image model. Reason, we use google collab to train model is google collab is gpu free to train model.

yolo need to high level gpu support machine to process model. After training 4 hours of our image model, we dowloaded our yolo file from google collab. Then we place the trained yolo model in python file. Now, finally we able to detect ambulance from the video with help of yolo trained model. The Figure 4.15 and 4.16 shows the Output image of ambulance detection.

Chapter 5

RESULTS, DISCUSSIONS AND CONCLUSIONS

5.1 Project Results

Computer vision detect the vehicle present and count the no.of vehicle using image processing. we incoprate the all software module to raspberry pi. with help of raspberry pi, opencv detect and count vehicle. if vehicle count is more in particular lane compare to other lane. Raspberry pi change the Signal from red to green, initally that lane will be in red. once lane is detected heavy traffic, it changes the traffic light signal.

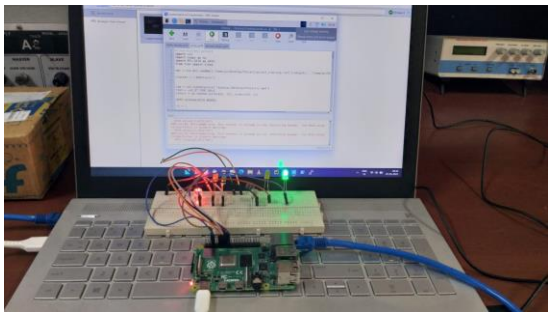

FIGURE 5.5: Traffic Density using Computer Vision 1

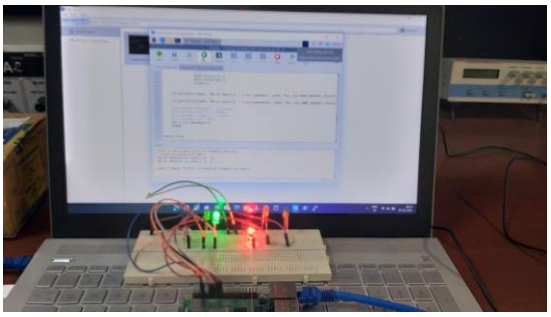

FIGURE 5.6: Traffic Density using Computer Vision 2

The Figure 5.5 and 5.6 shows the output of Computer vision to measure Traffic Density in a two lane. There are two lane. Our Computer vision detect real time traffic. so, we use video to detect the traffic. For two lane, two video we are using to compare which video/lane detect more no.of vehicle.

initially lane one is red signal and lane two is in green. when python file runs it count no.of vehicle in both video. In this lane 1 is detected more no.of vehicle.

So, Signal in lane 1 change from red to yellow, after 3 seconds it change to green.

Since lane 1 is detect more no.of vehicle,it need more green signal duration and other lane should be red. So when lane 1 change from red to yellow. lane 2 also change from green to yellow. Both Lane Yellow light will be light in same time without any delay. after 3 second, lane 2 change to yellow to Red.

Below Images are Both lane video footage (Raspberry output).

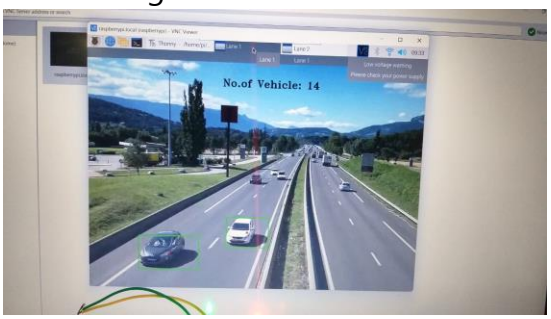

FIGURE 5.7: Traffic Density using Raspberry pi output 1

FIGURE 5.8: Traffic Density using Raspberry pi output 2

The Figure 5.7 and 5.8 shows the output video of Computer vision to measure Traffic Density in a two lane. Next to Find ambulance in lane, we use acoustic sensor to detect ambulance. when ambulance siren is detected by acoustic sensor, it gives signal to arduino uno to change the signal from red to green where all the lane are changed to red. ambulance will be prioritized first.

Apart from Acoustic sensor, we use computer vision to detect ambulance in lane. Here there are 2 lane. initally lane 1 is in red and lane 2 is in green. when Python file runs, it detect the ambulance in lane based on video. If ambulance is detected raspberry pi change the traffic signal accordingly.

For now, lane 1 have ambulance video. if ambulance is detected, it changes from red to yellow and after 3 second, it will change to green.In lane 2 it changes from green to yellow. Both Yellow in lanes will change in same time. then yellow in lane 2 change to red.

If ambulance is detected in both lane, computer vision will able to priotize lane. The lanes are priotized based on the bounding box area of ambulance.

if ambulance is far, size of ambulance in video is small, so bounding also smaller. if ambulance is near, Size of ambulance in video is large, so the bounding also larger. with this we able to priotize the lane, which lane ambulance is closer to traffic light.

Here, initially lane 1 is in red and lane 2 is in green. when Python file runs, it detect the ambulance in Both lane based on the video. First python read the bounding box area of both ambulances. Here Ambulance in lane 1 have more bounding box area, so it changes from red to yellow and after 3 second, it will change to green.In lane 2 it changes from green to yellow. Both Yellow in lanes will change in same time. then yellow in lane 2 change to red.

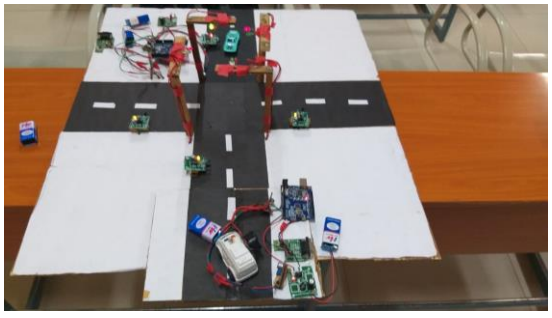

FIGURE 5.9: Ambulance Detection Using Acoustic Sensor

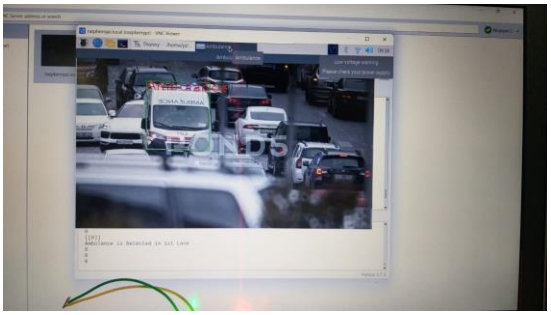

FIGURE 5.10: Ambulance Detection Using Computer Vison (Raspberry pi output)

after 10 seconds, Now lane 2 need to priotize because now ambulance 2 need to go. So, When Ambulance is crossed in lane 1. It changes to green to yellow and yellow red. Similarly lane 2 changes from red to yellow and yellow to green.

Finally Both ambulance crossed the lane without any problem. The Figure 5.9 and 5.10 shows the Ambulance detection using Acoustic sensor and Computer Vision.

5.2 Discussions

This research work proposes a image processing for managing heavy traffic control in a lane or junction and for managing heavy traffic control for healthcare-related emergencies Vechile.

5.3 Conclusions

In this Project we able to the optimize the traffic light controller in a city using image processing . For Ambulance detection, we used image processing. This traffic light system consist both the hardware and the software.

5.4 Scope for Future Work

The future scope includes traffic profiling, data storage, and traffic light management based on the obtained data. Profiling can also be used to investigate traffic density variations over the course of a day, week, month, or year. We can also enhance this technology for emergency vehicles like ambulances. The collected traffic data might be utilised to find alternative routes for a specific daily vehicle to avoid traffic congestion.

Bibliography

[1] Ahir, Deepali, Saurabh Bharade, Pradnya Botre, Sayali Nagane, and Mihir Shah, " Intelligent traffic control system for smart ambulance.", *IRJET 5*, pp.355 358, 2018.

[2] Parida, Pratyush, S. Dhurua, and S. Priya. " An intelligent ambulance with some advance features of telecommunication.", *International journal of emerging technology and advanced engineering*, vol.4, no.10, 2014.

[3] Kandhari, M. and Antonov, S., " Smart Traffic Control System for Ambulance." *Advanced aspects of theoretical electrical engineering Sofia, 16*, pp.95-98., 2016.

[4] Ramani, A. B., and Amruta Jeyakumar. " Smart Ambulance Guidance System." *International Journal of Advanced Research in Computer Science and Electronics Engineering*, 2018.

[5] Strazdins, Girts, et al. " Towards vehicular sensor networks with android smartphones for road surface monitoring." *International Journal of Advanced Research in Computer Science and Electronics Engineering*, vol.5, p.2015, 2011.

[6] Dagade, Pooja, Priyanka Salunke, Supriya Salunke, and Seema T. Patil. " Accident Detection and Ambulance Rescue System Using Wireless Technology." *International Research Journal of Engineering and Technology (IRJET)*, vol.4, no.5, 2017.

[7] Sarkar, Shantanu. "Ambulance assistance for emergency services using GPS navigation." *International Research Journal of Engineering and Technology (IRJET)*, vol.3, no.9, 2016.

[8] Kavya K, Dr. Geetha C R, Dept. of EandC, Sapthagiri College of Engineering. " Accident Detection and Ambulance Rescue using Raspberry Pi " , *International Research Journal of Engineering and Technology (IRJET)*, vol.2, no.3, 2016.

[9] Mr. Bhushan Anant Ramani, Prof. Amutha Jeyakumar, VJTI Mumbai. Smart Ambulance Guidance System, *International Journal of Advanced Research in Computer Science and Electronics Engineering*, 2018.

[10] Tejas Thaker, GTU PG School, Gandhinagar, "ESP8266 based implementation of wireless sensor network with Linux based web-server.", *IEEE*, pp.1 5, 2016.

[11] Varaprasad G. " High stable power aware multicast algorithm for mobile ad hoc networks.", *IEEE sensors journal*, vol.13, no.5, pp.1442-1446 2012 Dec